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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,716	03/03/2004	Masayoshi Takahashi	Q79574	2616
23373 7590 05/12/2009 SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037				
EXAMINER				
BOYER, RANDY				
ART UNIT		PAPER NUMBER		
1797				
MAIL DATE		DELIVERY MODE		
05/12/2009		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/790,716

**Applicant(s)**

TAKAHASHI ET AL.

**Examiner**

RANDY BOYER

**Art Unit**

1797

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12 March 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7 and 9-18 is/are pending in the application.
- 4a) Of the above claim(s) 10-17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 9 and 18 is/are rejected.
- 7) ☒ Claim(s) 2 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/5508)  
Paper No(s)/Mail Date 12 March 2009.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date: \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office Action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12 March 2009 has been entered.

### ***Response to Amendment***

2. Examiner acknowledges Applicant's response filed 12 March 2009 containing amendments to the claims, remarks, and Information Disclosure Statement.
3. Claims 1-7 and 9-18 are pending. Claims 10-17 are presently withdrawn as being drawn to a non-elected invention. Thus, only claims 1-7, 9, and 18 are pending for examination.

4. The previous rejections of claims 1-7, 9, and 18 under 35 U.S.C. 103(a) are withdrawn in view of Applicant's amendment to the claims and Examiner's discovery of prior art references not previously considered.
5. New grounds for rejection of claims 1-7, 9, and 18 under 35 U.S.C. 102(b) and/or 35 U.S.C. 103(a) are entered.
6. Finally, objection is made with respect to claim 2. The objection and rejections follow.

#### ***Claim Objections***

7. Claim 2 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim, or amend the claim to place it in proper dependent form, or rewrite the claim in independent form.
8. With respect to claim 2, the claim recites, in relevant part, "wherein a subset of the ultrafine bubbles have a diameter of 50  $\mu\text{m}$  or less." Because claim 1 (from which claim 2 depends) already contains such limitation, claim 2 does not "further limit" claim 1 and is therefore an improper dependent claim. Appropriate correction is required.

#### ***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1-4, 6, 7, and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Kawamura (M. Takahashi et al., *Effect of Shrinking Microbubble on Gas Hydrate Formation*, 107 J. PHYS. CHEM. B 2171-2173 (2003)).<sup>1</sup>

11. With respect to claims 1 and 2, Kawamura discloses a method for making gas hydrate comprising: (a) generating ultrafine bubbles in an aqueous solution (see Kawamura, page 2172); and (b) spontaneously generating hydrate nuclei by self-compression and collapsing of the ultrafine bubbles (see Kawamura, Fig. 4 with accompanying text); wherein the ultrafine bubbles have a diameter of 50  $\mu\text{m}$  or less (see Kawamura, Fig. 2 and Fig. 3 with accompanying text); wherein a high concentration of gas molecules are generated around the bubbles in the aqueous solution (see Kawamura, Fig. 4 with accompanying text), wherein the ultrafine bubbles are generated by a swirling two-phase flow process (see Kawamura, page 2172); and wherein a supercooling temperature for generating the hydrate is not more than 0.7°C from equilibrium conditions (see Kawamura, pages 2172-2173).

12. With respect to claim 3, Examiner submits that inasmuch as Kawamura discloses what reasonably appears to be the identical process claimed by Applicant, then a subset of Kawamura's ultrafine bubbles would necessarily (inherently) exhibit an ascending rate of 1mm/sec or less.

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<sup>1</sup> Examiner notes that the Kawamura reference has an internet publication date of 12 February 2003 which is more than one year prior to the earliest U.S. filing date for the instant application (3 March 2004).

13. With respect to claim 4, Kawamura discloses wherein the ultrafine bubbles are dissolved in the aqueous solution (see Kawamura, page 2173).

14. With respect to claim 6, Kawamura discloses using THF as a hydrate promoter to alter the equilibrium conditions above the freezing point at the ambient pressure, the THF serving to dissolve a larger quantity of ultrafine bubbles than would normally be dissolved at ambient pressure (see Kawamura, page 2172).

15. With respect to claim 7, Kawamura discloses wherein the gas hydrate nuclei are formed at a region of the solution above the metastable marginal curve by the collapsing phenomenon of the ultrafine bubbles (see Kawamura, Fig. 4 with accompanying text).

16. With respect to claim 9, Kawamura discloses wherein the ultrafine bubbles are generated by a bell ultrafine-bubble generator (see Kawamura, Fig. 1 with accompanying text).

***Claim Rejections - 35 USC § 102 / 35 USC § 103***

17. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to

be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

19. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

20. Claim 18 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kawamura (M. Takahashi et al., *Effect of Shrinking Microbubble on Gas Hydrate Formation*, 107 J. PHYS. CHEM. B 2171-2173 (2003)).

21. With respect to claim 18, Kawamura discloses a particulate gas hydrate prepared by the method for making gas hydrate according to the process of: (a) generating ultrafine bubbles in an aqueous solution; and (b) spontaneously generating hydrate nuclei by self-compression of the ultrafine bubbles (see Kawamura, entire disclosure).

22. Claim 18 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Takahashi (M. Takahashi et al., *A Novel Manufacturing Method of Gas Hydrate Using the Micro-Bubble Technology*,

PROCEEDINGS OF THE FOURTH INTERNATIONAL CONFERENCE ON GAS HYDRATES, pps. 825-828, Yokohama, Japan (May 19-23, 2002)).

23. With respect to claim 18, Takahashi discloses a particulate gas hydrate prepared by the method for making gas hydrate according to the process of: (a) generating ultrafine bubbles in an aqueous solution; and (b) spontaneously generating hydrate nuclei by self-compression of the ultrafine bubbles (see Takahashi, entire disclosure).

***Claim Rejections - 35 USC § 103***

24. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

25. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

26. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation



under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

27. Claims 1 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawamura (M. Takahashi et al., *Effect of Shrinking Microbubble on Gas Hydrate Formation*, 107 J. PHYS. CHEM. B 2171-2173 (2003)).

28. With respect to claims 1 and 5, see discussion *supra* at paragraph 11.

Kawamura does not explicitly disclose wherein the ultrafine bubbles are generated under a pressure of more than 1 atm.

However, Kawamura uses THF as a hydrate promoter to alter the equilibrium conditions above the freezing point above the freezing point at the ambient pressure – i.e. implying that hydrate formation would necessarily take place at pressures above atmospheric (1 atm) if THF were *not* used (see Kawamura, page 2172). Moreover, Kawamura explains that the radius of the gas bubbles ( $r$ ) is inversely proportional to the liquid pressure ( $P_l$ ) used in forming the microbubbles, according to the Young-LaPlace equation (see Kawamura, page 2173). Such being the case, the person having ordinary skill in the art would expect bubble size to decrease with a corresponding increase in liquid pressure.

Therefore, the person having ordinary skill in the art would have been motivated to modify the process of Kawamura to provide for bubble generation under a hydraulic

pressure of more than 1 atm in order to produce smaller-sized bubbles, thereby more efficiently generating hydrate nuclei.

Finally, the person having ordinary skill in the art would have had a reasonable expectation of success in modifying the process of Kawamura as described above because Kawamura implies hydrate generation at hydraulic pressures greater than atmospheric (1 atm).

29. Claims 1-6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (M. Takahashi et al., *A Novel Manufacturing Method of Gas Hydrate Using the Micro-Bubble Technology*, PROCEEDINGS OF THE FOURTH INTERNATIONAL CONFERENCE ON GAS HYDRATES, pps. 825-828, Yokohama, Japan (May 19-23, 2002)).

30. With respect to claims 1 and 2, Takahashi discloses a method for making gas hydrate comprising: (a) generating ultrafine bubbles in an aqueous solution (see Takahashi, page 825); and (b) spontaneously generating hydrate nuclei by self-compression and collapsing of the ultrafine bubbles (see Takahashi, page 827); wherein the ultrafine bubbles have a diameter of 50  $\mu\text{m}$  or less (see Takahashi, page 825); wherein a high concentration of gas molecules are generated around the bubbles in the aqueous solution (see Takahashi, page 828); and wherein the fine bubbles are generated by a swirling two-phase flow process (see Takahashi, page 825).

Takahashi does not explicitly disclose wherein a supercooling temperature for generating the hydrate is not more than 0.7°C from equilibrium conditions.

However, Takahashi discloses that the rate of hydrate nucleation increases due to the supersaturated condition of dissolved gas in the vicinity of shrinking microbubbles

as a result of the compressed pressure by the surface tension (see Takahashi, page 828). Takahashi goes on to explain that the increase in hydrate nucleation rate decreases the induction time of nucleation and permits the system to produce hydrate phase closer to equilibrium conditions (see Takahashi, page 828).

Therefore, Examiner finds Applicant's limitation "wherein a supercooling temperature for generating the hydrate is not more than 0.7°C from equilibrium conditions" to be of no patentable consequence since Takahashi explicitly favors hydrate nucleation close to equilibrium conditions.

31. With respect to claim 3, Examiner notes that the ultrafine bubbles generated in the process of Takahashi are of the same size claimed by Applicant (50  $\mu\text{m}$  or less) (see Takahashi, page 825). Thus, Examiner submits that the ultrafine bubbles of Takahashi would necessarily (inherently) exhibit an ascending rate of 1mm/sec or less.

32. With respect to claim 4, Takahashi discloses wherein the ultrafine bubbles are dissolved in the aqueous solution (see Takahashi, page 825).

33. With respect to claim 5, Takahashi uses THF as a hydrate promoter to alter the equilibrium conditions above the freezing point above the freezing point at the ambient pressure – i.e. implying that hydrate formation would necessarily take place at pressures above atmospheric (1 atm) if THF were *not* used (see Takahashi, page 826). Moreover, Takahashi explains that the radius of the gas bubbles ( $r$ ) is inversely proportional to the liquid pressure ( $P_L$ ) used in forming the microbubbles, according to the Young-LaPlace equation (see Takahashi, page 827). Such being the case, the person having ordinary skill in the art would expect bubble size to decrease with a

corresponding increase in liquid pressure. Therefore, the person having ordinary skill in the art would have been motivated to modify the process of Takahashi to provide for bubble generation under a hydraulic pressure of more than 1 atm in order to produce smaller-sized bubbles, thereby more efficiently generating hydrate nuclei.

34. With respect to claim 6, Takahashi discloses using THF as a hydrate promoter to alter the equilibrium conditions above the freezing point at the ambient pressure, the THF serving to dissolve a larger quantity of ultrafine bubbles than would normally be dissolved at ambient pressure (see Takahashi, page 826).

35. With respect to claim 9, Takahashi discloses wherein the ultrafine bubbles are generated by a bell-shaped ultrafine bubble generator (see Takahashi, Fig. 1 with accompanying text).

### ***Response to Arguments***

36. Applicant's arguments with respect to all claims have been considered but are moot in view of the new grounds of rejection.

### ***Conclusion***

37. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Randy Boyer whose telephone number is (571) 272-7113. The examiner can normally be reached Monday through Friday from 10:00 A.M. to 7:00 P.M. (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola, can be reached at (571) 272-1444. The fax number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RPB

/Glenn A Caldarola/

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